

U.S. Patent No: 5,465,635

slidable contact with the first section 5c of the flywheel body 5, and the radial section 4b of the reinforcing member 4 is spaced from the second section 5d of the flywheel body 5 by a predetermined distance for allowing an axial movement of the flywheel along with the elastic plate 2. In other words, a first free space is provided after second section 5d for allowing axial movement of the flywheel body. A radially extending inner surface 5f of the flywheel facing the elastic plate 2 is spaced apart from the elastic plate 2 by a predetermined distance for ensuring an elasticity of the elastic plate 2. In other words, a first clearance or second free space is provided between inner surface 5f and the elastic plate 2 for allowing axial movement of the flywheel body.--

IN THE SUBSTITUTE CLAIMS:

Please cancel claims 16 and 31 without prejudice or disclaimer and amend/correct the claims as follows:

28. (Amended) A flywheel assembly as set forth in claim 43, wherein an axial run-out of said engaging surface when rotated by said crankshaft is no more than 0.1 mm.

43. (Twice Amended) A flywheel assembly for a power transmission system for transmitting engine torque, comprising:

a crankshaft;

an elastic plate comprising an inner portion secured to a shaft end of said crankshaft;

a flywheel body secured to said elastic plate and having an engaging surface for engaging with a clutch disc; and

a reinforcing member for reinforcing said elastic plate at said inner portion of said elastic plate;

wherein said elastic plate has an axial rigidity in the range of 600 kg/mm to 2200 kg/mm so as to ensure transmission of engine torque through said flywheel assembly, while decreasing noise produced by a bending vibration of said crankshaft;

wherein said elastic plate is clamped axially between said reinforcing member and said shaft end of said crankshaft.

U.S. Patent No: 5,465,635

wherein a first portion of said flywheel body moves axially with respect to said reinforcing member and said elastic plate,

wherein said reinforcing member has a radially extending portion which extends at least inwardly of said flywheel body, and wherein said elastic plate comprises a first portion, said first portion of said flywheel body being placed axially after said first portion of said elastic plate, and said first portions of said flywheel body and said elastic plate defining a first clearance and said flywheel body having a first free space on a side opposite of the first clearance for allowing said first portion of said flywheel body to move axially within the first clearance and the free space.

44. (Amended) A flywheel assembly according to claim 43, wherein said first portions of said flywheel body and said elastic plate define a second free space consisting essentially of said first clearance.

47. (Amended) A flywheel assembly for a power transmission system for transmitting engine torque, comprising:

a crankshaft;

an elastic plate comprising an inner portion secured to a shaft end of said crankshaft;

a flywheel body secured to said elastic plate and having an engaging surface for engaging with a clutch disc; and

a reinforcing member for reinforcing said elastic plate at said inner portion of said elastic plate;

wherein said engaging surface has an axial run-out which is no more than 0.1 mm;

wherein said elastic plate is clamped axially between said reinforcing member and said shaft end of said crankshaft,

wherein a first portion of said flywheel body moves axially with respect to said reinforcing member and said elastic plate,

wherein said reinforcing member has a radially extending portion which extends at least inwardly of said flywheel body, and wherein said elastic plate comprises a first portion, said first portion of said flywheel body being placed axially after said first portion of said elastic plate, and said first portions of said flywheel body and said elastic

U.S. Patent No: 5,465,635

plate defining a first clearance and said flywheel body having a first free space on a side opposite of the first clearance for allowing said first portion of said flywheel body to move axially within the first clearance and the free space.

48. (Amended) A flywheel assembly according to claim 47, wherein said first portions of said flywheel body and said elastic plate define a second free space consisting essentially of said first clearance.

50. (Amended) A flywheel assembly according to claim 47, wherein said elastic plate has an axial rigidity in the range of 600 kg/mm to 2200 kg/mm so as to ensure transmission of engine torque through said flywheel assembly, while decreasing noise produced by a bending vibration of said crankshaft; and wherein said flywheel body axially moves corresponding to said axial rigidity of said elastic plate in the range of 600 kg/mm to 2200 kg/mm without contact on its radial surfaces when said flywheel is engaged and disengaged.

51. A flywheel assembly as set forth in claim 43, wherein said axial rigidity is in the range of 600 kg/mm to 1700 kg/mm.

53. A flywheel assembly according to claim 43, wherein said elastic plate is clamped axially between said reinforcing member and said shaft end of said crankshaft by a fastening means.

55. A flywheel assembly according to claim 54, wherein said inner portion of said flywheel body comprises a first surface (5f) which is parallel to said engaging surface (5g) and which faces toward said elastic plate, and a second surface (5d) which is parallel to said engaging surface, said inner portion of said elastic plate comprising an abutting surface confronting said first surface of said flywheel body and limiting an axial movement of said inner portion of said flywheel body by abutting against said first surface of said flywheel body.

57. A flywheel assembly as set forth in claim 43, wherein:

U.S. Patent No: 5,465,635

said elastic plate is a circular elastic plate (2) which further comprises an outer portion, and said inner portion extends radially inwardly from said outer portion to said inner portion;

said fly wheel body is an annular flywheel body (5) which comprises an outer portion and an inner portion and extending radially inwardly from said outer portion to said inner portion of said flywheel body, said outer portion of said flywheel body being fastened to said outer portion of said elastic plate, said inner portion of said flywheel body comprising a central circular hole; and

said reinforcing member further comprises a cylindrical portion (4a) axially extending from a first member end to a second member end, an inner portion extending radially inwardly from said first member end of said cylindrical portion, and an outward flange (4b) extending radially outwardly from said second member end of said cylindrical portion, said inner portion of said reinforcing member being fastened to said shaft end of said crankshaft, said cylindrical portion of said reinforcing member being fit in said circular hole of said flywheel body with a clearance to form a loose fit;

wherein said inner portion of said elastic plate is fixedly clamped between said shaft end of said crankshaft and said inner portion of said reinforcing member, said inner portion of said flywheel body is fit over said cylindrical portion of said reinforcing member.

60. A flywheel assembly as set forth in claim 47, wherein said elastic plate has an axial rigidity in the range of 600 kg/mm to 2200 kg/mm so as to ensure transmission of engine torque through said flywheel assembly, while decreasing noise produced by a bending vibration of said crankshaft.

63. (Amended) A flywheel assembly according to claim 62, wherein said inner portion of said flywheel body comprises a first surface (5f) which is parallel to said engaging surface (5g) and which faces toward said elastic plate, and a second surface (5d) which is parallel to said engaging surface, said inner portion of said elastic plate comprising an abutting surface confronting said first surface of said flywheel body and limiting an axial movement of said inner portion of said flywheel body by abutting against said first surface of said flywheel body.

U.S. Patent No: 5,465,635

65. (Amended) A flywheel assembly as set forth in claim 47, wherein:
said elastic plate is a circular elastic plate (2) which further comprises an
outer portion, and said inner portion extends radially inwardly from said outer portion to
said inner portion:

said fly wheel body is an annular flywheel body (5) which comprises an
outer portion and an inner portion and extending radially inwardly from said outer portion
to said inner portion of said flywheel body, said outer portion of said flywheel body being
fastened to said outer portion of said elastic plate, said inner portion of said flywheel body
comprising a central circular hole; and

said reinforcing member further comprises a cylindrical portion (4a) axially
extending from a first member end to a second member end, an inner portion extending
radially inwardly from said first member end of said cylindrical portion, and an outward
flange (4b) extending radially outwardly from said second member end of said cylindrical
portion, said inner portion of said reinforcing member being fastened to said shaft end of
said crankshaft, said cylindrical portion of said reinforcing member being fit in said
circular hole of said flywheel body with a clearance to form a loose fit:

wherein said inner portion of said elastic plate is fixedly clamped between
said shaft end of said crankshaft and said inner portion of said reinforcing member, said
inner portion of said flywheel body is fit over said cylindrical portion of said reinforcing
member.

Please add the following new claims:

--69. A flywheel assembly according to claim 43, wherein said radially
extending portion further comprises a radially extending section (4b) at least partially
overlapping the first portion of said flywheel body in a radial direction.

70. A flywheel assembly according to claim 47, wherein said radially
extending portion further comprises a radially extending section (4b) at least partially
overlapping the first portion of said flywheel body in a radial direction.

U.S. Patent No: 5,465,635

71. A method for shifting a resonance frequency of a flexural or bending vibration of a crankshaft assembly of an internal combustion engine out of a target frequency band of a forced vibration, comprising:

(a) providing a clutch having a clutch disk with a clutch facing coupled to a transmission;

(b) providing a flywheel assembly flywheel assembly of a power transmission system for transmitting engine torque, said flywheel assembly comprising:

a crankshaft;

an elastic plate comprising an inner portion secured to a shaft end of said crankshaft;

a flywheel body secured to said elastic plate and having an engaging surface for engaging with the clutch disc; and

a reinforcing member for reinforcing said elastic plate at said inner portion of said elastic plate;

wherein said elastic plate has an axial rigidity in the range of 600 kg/mm to 2200 kg/mm so as to ensure transmission of engine torque through said flywheel assembly, while decreasing noise produced by a bending vibration of said crankshaft;

wherein said elastic plate is clamped axially between said reinforcing member and said shaft end of said crankshaft, and

wherein a first portion of said flywheel moves axially with respect to said reinforcing member and said elastic plate,

wherein said reinforcing member has a radially extending portion which extends at least inwardly of said flywheel body, and wherein said elastic plate comprises a first portion, said first portion of said flywheel body being placed axially after said first portion of said elastic plate, and said first portions of said flywheel body and said elastic plate defining a first clearance and said flywheel body having a first free space on a side opposite of the first clearance for allowing said first portion of said flywheel body to move axially within the first clearance and the free space;

(c) engaging said clutch with said flywheel assembly to transmit the driving power to the transmission to through the clutch;

(d) accelerating the clutch and flywheel assembly, wherein the clutch and flywheel assembly vibrates at a frequency of from 200 to 500 Hz during acceleration.

U.S. Patent No: 5,465,635

72. A method according to claim 71, wherein the axial displacement of the engaging surface is no more than 0.1 mm when an axial load of 600 kg to 2200 kg is applied to the engaging surface.

73. A method according to claim 71, further comprising: (e) disengaging said clutch from said flywheel assembly.

74. A method for shifting a resonance frequency of a flexural or bending vibration of a crankshaft assembly of an internal combustion engine out of a target frequency band of a forced vibration, comprising:

(a) providing a clutch having a clutch disk with a clutch facing coupled to a transmission;

(b) providing a flywheel assembly flywheel assembly of a power transmission system for transmitting engine torque, said flywheel assembly comprising:

a crankshaft;

an elastic plate comprising an inner portion secured to a shaft end of said crankshaft;

a flywheel body secured to said elastic plate and having an engaging surface for engaging with the clutch disc; and

a reinforcing member for reinforcing said elastic plate at said inner portion of said elastic plate;

wherein said elastic plate has an axial rigidity in the range of 600 kg/mm to 2200 kg/mm so as to ensure transmission of engine torque through said flywheel assembly, while decreasing noise produced by a bending vibration of said crankshaft;

wherein said elastic plate is clamped axially between said reinforcing member and said shaft end of said crankshaft, and

wherein a first portion of said flywheel moves axially with respect to said reinforcing member and said elastic plate,

wherein said reinforcing member has a radially extending portion which extends at least inwardly of said flywheel body, and wherein said elastic plate comprises a first portion, said first portion of said flywheel body being placed axially after said first portion of said elastic plate, and said flywheel body having a first free space on a side

U.S. Patent No: 5,465,635

opposite of the flywheel facing the elastic plate for allowing said first portion of said flywheel body to move axially within the free space;

(c) engaging said clutch with said flywheel assembly to transmit the driving power to the transmission to through the clutch;

(d) accelerating the clutch and flywheel assembly, wherein the clutch and flywheel assembly vibrates at a frequency of from 200 to 500 Hz during acceleration.